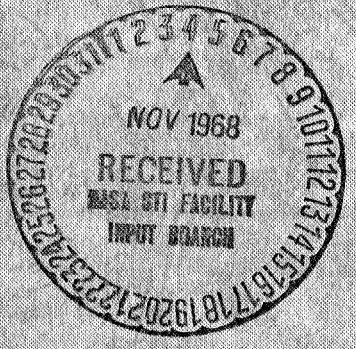

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PROBING THE MYSTERIES OF THE PLANETS

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PROBING THE MYSTERIES OF THE PLANETS

by

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The Earth is a component part of an entire system of planets which orbit around the Sun. This sytem is distinguished by many clearly expressed laws which obviously depend upon the conditions of its creation. All planets move around the Sun in the same direction, in approximately the same plane, and along almost circular orbits at considerable distances from each other. The size of these orbits increases approximately in a geometrical progression; each consecutive planet is located 1.5 to 2 times farther from the Sun than the preceding planet.

From Mercury to Pluto

The planets are divided into two sharply distinguished groups according to their physical properties. There are planets of the terrestrial type, a representative of which is our own Earth, and there are external planets, a representative of which is the gigantic Jupiter.

The first group of planets occupies an internal position in the solar system. To these belong Mercury (0.39), Venus (0.72), the Earth (1.00) and Mars (1.52).[a]

[a]The respective radii of their corresponding orbits, as a ratio to the radius of the Earth's orbit, which equals 150 million km.

This group of planets is distinguished by comparatively small masses, great densities, sufficiently slow rotations around their axes, and rarefied atmospheres in which compounds of nitrogen and oxygen prevail, plus water, carbon dioxide, etc. The planets of this group with smaller masses have atmospheric covers that are very rarefied. Mars has a mass 10 times less than the mass of the Earth. The atmospheric pressure on the surface of Mars is approximately 10 times less than on the Earth. The nearest planet to the Sun, (Mercury), with a mass which is 20 times smaller than that of the Earth, does not possess an atmosphere at all. This planet presents the same side to the Sun at all times.

It will be of interest to notice that such a broadly distributed element in the cosmos as hydrogen, which dominates in the Sun and in the external planets, takes up an entirely secondary position in the contents of planets of the terrestrial type. In the terrestrial crust,for instance, the principal role belongs to oxygen, with hydrogen here occupying only the eighth place.

The external planets Jupiter (5.2), Saturn (9.5), Uranus (19.2), Neptune (30.1), and Pluto (39.5), are distinguished by large masses (the mass of Jupiter is 380 times that of the Earth), comparatively low densities, and rapid rotations around their axes (a day on Jupiter is only 9 hr, 50 min). Surrounded by dense atmospheres in which compounds of hydrogen, methane, and ammonia prevail, they have extremely heterogenic internal structures. Hydrogen prevails in their contents. At the present time, it is believed that the mass of Jupiter consists of 80% hydrogen, approximately 15% helium, and only 5% of the remaining heavier elements.

We will notice in the study of the history of planets, the systems of the satellites which rotate around these planets are of extreme importance. While Mercury and Venus do not have any satellites at all and the Earth has only one Moon (which has played a large role in the formation of the Earth as a stable planet), Jupiter has 12 Moons, Saturn has 9 , Uranus has 5, and Neptune has 2 large satellites.

The most distant planet of the solar system is Pluto. Pluto represents a sharp exception from the group of external planets. The measurements of its mass and its dimensions testify to an unbelievably large density of matter (50 times more dense than water), which cannot, however, be considered as accurately established. Pluto travels over an inclined, elongated orbit. According to all indications, it is possible to assume that Pluto is probably a former satellite of Neptune.

In The Domain of Asteroids

In addition to the large planets, a unique class of small planets or asteroids exists also in the solar system. These bodies prevailingly follow entangled orbits occupying the area between the orbits of Mars and Jupiter. At present, the total number of asteroids with known orbits exceeds 1500, the largest being Cerera, Pallada, and Vesta. The diameters of these asteroids are in the hundreds of kilometers.

The majority of asteroids appear to be small fragments of irregular form, which rotate on their axes with periods on the order of a few hours. Irregularly reflecting the solar light, the asteroids are visible to us in the form of heavenly

bodies of changing brightness; for instance, widely known is the asteroid Eros which is used for the determination of the scale of the solar system and which has the shape of a bar with a length of 10 km and width of 4 km.

The variety of orbits of the asteroids is of great interest. For instance, the orbit of Hidalgo, goes out so far from the realms of the asteroid ring that it approaches the orbit of Saturn. Such asteroids as Icarus penetrate deep into the Earth's orbit. The majority of asteroids, however, remain in the area between Mars and Jupiter.

It is important to notice that all asteroids, without exception, travel in the same direction around the Sun just like the large planets. This is why unavoidable collisions take place with only a relatively small velocity.

Meteorites are fragments of asteroids which fall to the surface of the Earth. The study of the isotopic contents of these asteroids, particularly the contents of the isotope of helium-He3 (which is obtained by exposing small masses to cosmic radiation), makes it possible to establish sufficiently accurately when the asteroid broke into small particles.

Along The Trails of Comets

Thus, interplanetary space gradually fills up with meteoric matter and small cosmic dust which gradually falls into the Sun.

To an even larger degree, the interplanetary space is being filled with dust as a result of the disintegration of comets. These are unique bodies of an entirely unusual nature, which roam in great numbers through the external regions of the

solar system and at times show up even in the internal parts of the solar system, where they are subjected to rapid disintegration.

There does not exist as yet a generally accepted opinion in regard to the nature and origin of comets. But most probably, according to the accumulation of available data, it should be considered that these bodies represent a concentration of small particles which were created during very low temperatures in distant external parts of the original gas-dust clouds, (perhaps simultaneously with the creation of the Sun, and the planets from it), about 4 to 5 billion years ago. Comets consist of a combination of the most common elements in space-heavy elements such as iron and calcium, and light elements like hydrogen, oxygen, and carbon, which solidify at very low temperatures.

Such a complicated conglomeration of particles of ice and ordinary, tough melting compounds, after its penetration into the internal regions of the solar system, begins at a low warming by solar rays to explode and discharge great quantities of gas and fine dust, which compose the tail of the comet. Quite often visible to us, this tail commences to disintegrate into meteoric fluxes which create during their encounter with the Earth the known phenomena which we call "falling stars".

In this manner interplanetary space becomes filled with fine cosmic dust which disperses solar light and causes the phenomena of zodiacal light. This phenomena was named so because it is primarily concentrated in the region of the Zodiac constallations over which the Sun passes during its apparent annual movement over the sky.

Comets travel around the Sun over even more varying orbits in forward and reverse directions. Just like meteorites, comets can collide with the Earth and with other planets, but the effect of such collisions is entirely different. When a heavy meteorite, (fragment of an asteroid,) collides with the Earth, it penetrates freely through our protective atmospheric cover, although the meteorite undergoes the fusion and usually breaks up into small separate particles. A good example of such a collision is the Sikhote-Alinsk meteorite with a mass of about 1000 tons. During its impact on Earth on February 12, 1947, this meteorite created more than a hundred craters and funnels.

The largest of the known craters of meteoric origin preserved to our present time is the crater Chabb in northern Canada with a diameter of about 3 1/2 km. Europe has only one known crater field consisting of 7 craters which were created by a falling meteorite about 5000 years ago. This field is located in Estonia on the island of Saarema. The largest of these craters is well preserved and has a diameter of 110 meters.

Comets should not collide with the Earth less often than heavy crater-forming meteorites; however, collisions of comets do not leave any traces which could be preserved for a long period of time (as an example, the impact of a comet in the region of Vanovara in central Siberia on July 30, 1908, which was at first erroneously ascribed to a common meteorite).

From The Sun's Interior

Another source of matter in the dispersed domain of interplanetary space is the Sun itself. In addition to its usual ray energy and radio waves, which normally increase during the time of disturbances in the corona, the Sun discharges fluxes of corpuscles which consist of mixtures of ionized gas and free electrons, that travel with velocities of thousands of km/sec.

It might also be said that the external cover of the Sun (corona) extends to a distance of many tens of solar radii until it finally dissolves into interplanetary space. In a similar manner, the uninterrupted escape of gases into space takes place from the internal layers of the atmosphere of planets (particularly our Earth) which, as was proven by recent investigations, are signified by a very high temperature. This pertains particularly to such light gases as oxygen and helium.

In addition, the interplanetary space is also pierced by cosmic rays which come from the surrounding cosmos and particularly from the Sun. These rays are actually nuclei of various elements, mainly hydrogen, which travel almost with the speed of light.

The atmosphere of the Earth protects us very reliably from all these radiations and from direct falls of small dust particles, which are dangerous as a result of their cosmic velocity. However, out in interplanetary space and also on the surface of planets on which any type of atmosphere is absent (for instance on Mercury, asteroids, and many satellites of planets, including our own Moon), proper preventive measures should be taken. Even on Mars, where an atmospheric ozone filter

is absent, it is necessary to take preventive steps against extreme ultraviolet radiation from the Sun, which has a deadly effect on live organisms.

The Mysteries of Mars

Of utmost interest to us are our nearest neighbors Mars and Venus and the external planet Jupiter.

Mars revolves around the Sun at a distance of 1.52 times farther than the Earth and, therefore, receives correspondingly less solar heat, but, nevertheless, the temperature on its surface might rise above zero considerably about noon time. In addition, since the days of Mars consist of 24 hr: 37.4 min, and its equatorial inclination toward the plane of its orbit is almost the same as in the case of the Earth, an analogous change of seasons to that on Earth takes place. In spite of the fact that the atmosphere of this planet is many times rarer than on the Earth, carbon dioxide in quantities twice as large as on the Earth was detected in the contents of this atmosphere. Basically, the Martian atmosphere consists of nitrogen with an insignificant admixture of water vapors. It has been impossible to detect any free oxygen in the atmosphere of Mars.

Three-eighths of the surface of Mars is covered with dark spots which were assumed to be seas by observers of the 19th century and were named accordingly Later observers, considering the heterogenic speckled structure of these spots, have surmised that the uniform broad spaces of a reddish yellow color (the so called *matrices* or, more accurately, deserts) are caused by a developed vegetation. Such a viewpoint was aided by the observed regular seasonal changes on Mars. With the approach of spring, these dark spots became even darker and adopt a more green

coloration. At the same time an intensive thawing of polar snows takes place; the polar cap, which is sharply distinguished by its lightness and which consists of snow layers or sleet with clouds above, hanging high in the atmosphere, begins rapidly to diminish in size. This phenomenon, incidentally, discloses the presence of mountains on Mars.

It is possible to assume at the present time that a high form of vegetation is absent on Mars and that, consequently, living beings are also absent on the surface of Mars. First, there is no oxygen which is discharged by vegetation during its growing process. The dark spots on Mars become heated and increase their temperature in accord with their low reflection capabilities. This points out the fact that the solar radiation which is absorbed by these spots is not wasted on chemical processes as is always the case in the presence of vegetation.

However, it is entirely probable that on this planet there exists some kind of a low form of life which does not require water for its creation, a form of life which is absent on Mars and which probably never has existed there. This low form of life might be a type of lichens which cover broad sections of the surface in a smooth layer.

Another indication which supports the presence of organic life on Mars might be the results of observations of the seasonal changes of polarization of the dark spots in comparison with lifeless deserts. It appears that, with the approach of spring and with the beginning of darkening of the "seas", there begins also a change in the degree of their polarization. This somehow indicates the morphological changes of matter, which covers these places on the surface of the planet.

The content of water in the atmosphere of Mars is so low that it cannot be discovered by spectroscopic means.

Sand storms often take place on the surface of Mars. A yellow cloud swiftly spreads out during that period over the entire planet, covering even the polar caps.

Beyond The Clouds of Venus

In regard to the nature of another neighboring planet, Venus, very little can be reported. The surface of Venus is always obscured by a thick layer of clouds. It is even difficult to say how long its days are and how its rotational axis is oriented. Above the cloud cover of the planet and on the illuminated side (with a temperature of about +30°C), there extends a powerful layer of carbon dioxide. Its contents exceed by many times the amount of carbon dioxide in the Earth's atmosphere; however, free oxygen was not detected.

Of great interest is the fact that the dark part of the disk of Venus, which is not illuminated by direct solar rays, glows with a weak light of its own. This corresponds to the illumination of our night sky, but with a many times stronger intensity. The radiation of nitrogen and its combination with oxygen were discovered in this area. The character of light polarization which is reflected by the cloud layer makes it possible to draw the conclusion that it consists of fine droplets with a diameter of several microns, consisting possibly of water. Unfortunately, nobody can explain what is hidden beyond these cloud layers. Some people even think that the entire surface of this planet is covered by huge oceans. It would be extremely important to apply in this investigation radio methods at the closest

distance from the planet. At present, powerful radar installations are capable of detecting weak radio signals from Venus; however, this data serves only for the purpose of correcting the distance of Venus from the Earth.

Radio Waves From Jupiter

In a like manner, deep and interesting problems which are awaiting their solutions are connected with the gigantic Jupiter. On this planet can also be observed only cloud layers, which consist mainly of condensed ammonia; however, this layer is very heterogenic. Jupiter's cloud layer has an abundance of separate, sharply defined clouds. Among them are such amazing formations as the famous red spot of an oval form with dimensions which exceed our continents. This spot has been observed for hundreds of years without visible changes, sometimes covered by a thin veil.

Dark bands on Jupiter which are parallel to its equator separate its zones with various rotation speeds which generally vary from 9 hr: 50 min to 9 hr: 55 min: 40 sec. In spite of the very low temperature of Jupiter's cloud cover (about 140 deg below zero), this planet is a powerful source of radio emission, and sometimes even real radio storms. This indicates strong electrical discharges in its atmosphere and agrees well with the sharp changes in cloud formations on its disk as observed through telescopes.

Of great interest is the fact that certain observations of radio emissions from Jupiter at a length of 3 cm disclose almost an equally low temperature, but at a wavelength of 10 cm the temperature is about 300 deg above zero, and at a wavelength of 31 cm the temperature exceeds 5000 deg, whereby this corresponds

closely with the large dimensions of the disk of the planet. Thus, it seems that this distant planet is obviously surrounded at a considerable distance by extended zones of increased electron concentration of an as yet unknown origin.